

BIOLOGICAL CONTROL OF THE BALSAM WOOLLY APHID
IN OREGON AND WASHINGTON

By

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One year ago at the ESA meeting in Portland, it was mentioned briefly in a paper by Mr. N. E. Johnson and myself that we hoped to begin a program of biological control against the balsam woolly aphid, currently the most destructive forest insect in the Pacific Northwest. A program is now well underway. The purpose of my paper is to tell you what is being done, and what is planned.

The balsam woolly aphid, Chermes piceae (Ratz.) is a tiny phylloxerid that damages forest trees in several parts of the world. It was introduced about 1900 to eastern Canada and the Northeastern United States, where it is highly destructive to balsam fir forests. By 1930 it had made its way to the Pacific Coast. No large infestations were reported in this region, however, until 1954 when it was found causing widespread tree-killing of true fir forests in western Oregon and Washington. The epidemic continued to expand rapidly, and by the end of 1957 surveys showed that more than 600,000 acres of valuable timber and recreation forests were infested. Several billion board feet of prime timber have already been killed or seriously damaged.

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Since high-value private as well as public forests were involved, I am sure you can understand why forest entomologists were urgently requested to develop control measures. Research findings in Europe and Canada convinced us that no direct control, such as the use of chemicals, was feasible. There was some evidence that forest management practices offered long-term control possibilities, but obviously would do little toward suppressing the present epidemic. The end result was that we began, in 1956, to investigate the possibilities of biological control.

In its native Europe the balsam woolly aphid has numerous natural enemies, mainly predaceous insects, which assist in holding it in check. As might be expected, the aphid was imported without its predators. We were extremely fortunate that the Division of Forest Biology of the Canadian Department of Agriculture had been conducting studies and importing predators of the balsam woolly aphid since 1933. We are happy to have with us in the audience today a man who knows the balsam woolly aphid from A to Z and who sparked the predator importation program in Canada - Dr. R. E. Balch, of the Fredericton, New Brunswick, Forest Biology Laboratory. Summaries by the Canadian entomologists disclosed that eleven species of insect predators were introduced from eastern Europe to Canada from 1933 to 1955. Four of the eleven species were Coleoptera (families Coccinellidae and Derodontidae), five were Diptera (families Chamaemyiidae, Itonididae, and Syrphidae), and two were Neuroptera (family Hemerobiidae). The number of predators imported of any one species varied from less than 50 to more than 30,000.

Canadian reports showed that by 1955 three of the eleven species were established at least in localized areas, and one (a dipteran Neoleucopis obscura) was present in New Brunswick, Nova Scotia, and Prince Edward Island, and had also spread into Maine. Control benefits by the established predators had not been great so far. However, since most of the successful colonizations had been since 1951, it was felt that sufficient time had not yet elapsed for them to exert widespread effects on the host.

After review of the Canadian experiences, we felt that a biological control program, through introduction of its European predators, offered a possible means of controlling the balsam woolly aphid. A cooperative program was subsequently worked out between the U.S. Forest Service and the Canadian Department of Agriculture, which paved the way for us to begin receiving parts of shipments which were currently coming into Canada.

We received our first shipment of predators early in July, 1957 -- 10,000 larvae and pupae of Aphidoletes thompsoni Mohn. (Diptera: Itonididae) from Czechoslovakia. From these we reared and released about 2,000 adult flies. This year we have received additional shipments through Canada of two species:

8,650 adults of Laricobius erichsonii (Coleoptera: Derodontidae) from
Czechoslovakia

720 adults of Aphidecta oblitterata (Coleoptera: Coccinellidae) from
Sweden

In addition to these shipments from Europe, via Canada, we have also received this spring a shipment of 700 adults of the European dipterous predator Neoleucopis obscura (Chamaemyiidae) from the U.S. Forest Service Insect Laboratory at New Haven, Connecticut. These predators were collected in Maine, where they have become established following colonization in nearby New Brunswick.

A few remarks on the shipment of the European predators we have received may be of interest. The collections are made in Europe by various representatives of the Commonwealth Institute of Biological Control, which is financed in part by Canada. They are shipped by air to the Canadian biological control laboratory, at Belleville, Ontario, where they are screened and distributed to Canadian points and to us at Portland, Oregon. Our shipments are received via Air Express and total time in transit from the shipping points in Europe is about five days. Even though the shipments have not been iced in transit, food is provided in the shipping boxes and the insects have arrived in good to excellent condition. The Coccinellids have been especially good travelers.

When the size of the shipments permitted, colonies of about 1,000 predators each have been released. The beetles have been predominantly released "free"; that is, by merely turning them loose at the bases of trees with heavy bole infestations of the aphids. The two species of diptera received have been released in screen cages enclosing about three feet of the bole of infested trees; the cages are removed after time for mating has elapsed.

Releases have been made at five widely spaced locations in Oregon and Washington, and have been divided between the three principal species of true fir being damaged by the aphid -- alpine fir (Abies lasiocarpa), Pacific silver fir (A. amabilis), and grand fir (A. grandis).

The U.S. Forest Service is cooperating in this biological control program by assigning Mr. P. B. Dowden to Japan to look for predators that may be effective against the balsam woolly aphid. Mr. Dowden went to Japan in late April of this year. So far, he has found a promising species of Coccinellid that feeds on a near relative of the balsam woolly aphid (Chermes todomatsui) in Japan. Eggs of this species have been sent to Canada and to the Agricultural Research Service Laboratory at Riverside, California for screening and testing. If they appear promising, attempts will be made to secure colonies for release in Canada and the Pacific Northwest. At last report, the eggs sent to Canada had hatched and the larvae were feeding on the balsam woolly aphid. Mr. Dowden will remain in Japan until September. Before returning, he will attempt to line up Japanese collectors who will send shipments of predators to us and the Canadians in future years.

The entomology department of Oregon State College is also cooperating in the biological control program. Working on a grant from the U.S. Forest Service, the College has assigned a doctor's degree candidate to the project, and is also providing technical assistance on other aspects of the balsam woolly aphid problem. Entomologists of Weyerhaeuser Timber Company are also assisting us in the program by providing release areas, assisting in the colonization and evaluating the results.

It is, of course, too soon to assess establishment of the introduced predators in Oregon and Washington. We were encouraged last fall when first generation larval progeny of Aphidoletes thompsoni introduced in 1957 were recovered at two release points. Limited searching this spring has failed to find them. The two species of beetles introduced this spring also appear promising. They arrived in good condition, they mated, and many of them still are alive and feeding on the aphid population almost a month after release. Eggs of the Coccinellid Aphidecta oblitterata were observed hatching on June 20.

In addition to working with introduced predators, we are studying the native predators that feed on the balsam woolly aphid in Oregon and Washington. So far we have found three dipterons, a neuropteron, and a mite that prey significantly on it. We are continuing the study of native predators in cooperation with Oregon State College. In case promising species are found, attempts will be made to collect them in quantity for colonization in Canada, the northeastern states, and elsewhere.

In closing, I would like to emphasize and acknowledge again the outstanding cooperation we have received from Canada in this program. Although our contributions in return have been small to date, we hope to begin reciprocating soon. It is encouraging that international boundaries are not necessarily barriers to control of common insect problems.